1) Find gradient = =

2) Equation of tangent:

3) Gradient of normal =

4) Equation of normal:

**Questions:**

1) Calculate the gradient of the curve given by at the point (-1, 10).

2) Find the equation of the tangent to the curve given by at (2, 14).

3) Find the equation of the normal to the curve given by when = -1.

(Ex 12.1)

**Implicit Differentiation:**

4) Use implicit differentiation to calculate the equation of the tangent

to the circle at the point (-8, 6).

5) Differentiate , and calculate the equation of the normal

at the point (2, 1).

(Ex 13.1)

**Parametric Differentiation:**

Parametric Equations in and are ones where both and are defined in terms of a

third variable, called a **parameter**. The parameter is often , representing time.

Example: are the parametric equations for an object that starts at the origin at

time 0, and its position relative to the -axis after seconds is given by and its

position relative to the -axis after seconds is given by .

When time, , is known, the (x, y) position can be calculated:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 0 | 1 | 2 | 3 | 4 | 5 |
|  | 0 | 3 | 6 | 9 | 12 | 15 |
|  | 0 | 1 | 4 | 9 | 16 | 25 |

6) The parametric equations define a curve. Calculate

the equations of the tangent and the normal to the curve at the point (8, -1).

(Ex 17.2)